

The Effect of Design on Performance in Surgical Practice: Improving Instrumentation

Simplicity, harmony, and seamless function are concepts that can make the understanding and execution of surgical practice less daunting. Simple concepts that hold their truth in the face of complex situations are precious. These simple truths may be biologic principles, techniques, or instrumentation. They serve as the “pearls of wisdom” that are passed across generations of surgeons. These pearls may be about the relative merits of the Hargis chisels over the sagittal spreaders for ramus osteotomies or the qualities of dental elevator handle design. They are best remembered as the advice of teachers.

- Impaction surgery: “Keep your wrist lower than your elbow and your back might last the day.”
- Trauma surgery: “You have to see it to plate it.” “Mind the lingual side, lest the face be too wide.”
- Infections: “Put the penrose *over* the end of the hemostat, *not* through it”
- Implants: “Put it where it belongs, not where it fits”
- Orthognathic surgery: “Passively mobilize the maxilla and you will properly position the condyle.”

The teacher’s advice evokes the feel of the instrument and most importantly what it is supposed to be like when it’s right. As surgeons we are both the beneficiaries and the victims of technique. We learn to know the sound, the touch, the look, the rhythm, and even the smell of surgical manipulation that is proceeding as it should. To do all of these things well, we develop a special relationship with our instruments. It is a relationship developed on understanding, perseverance, tolerance, and equanimity. But it is a relationship that is often put to the test, a test that only the surgeon can solve, since instruments do not negotiate.

A Visit With an Instrument Designer

It was a rare opportunity to talk to a surgical instrument designer. What fun, what a chance for payback over all the shoddy anti-ergonomic instruments in our surgical sets—a chance to reminisce over the stress of working with flawed designs over a career in oral and

maxillofacial surgery and an opportunity to validate opinions over the shortcomings of our tools. There were elevator handles that would only fit the paw of a prizefighter, screwdrivers that made ones wrist turn over with excruciating consequences after the first few plates were placed, and implant drivers that reminded one of changing spark plugs in an Italian sports car. The frustrations of instrument design welled up as the designer passed his clay models around the room.

A series of surgeons met with the designer and he took careful notes to elicit the features that will create the greatest good for the most surgeons. Eavesdropping on the conversations revealed a central flaw in our chance to improve surgical design. Every surgeon had a different opinion! Some held their handpiece like a tennis racket and others like a pencil. Bulky versus refined, rigid versus malleable, blue marks versus red—there was no consensus. Now that might be the crux of design flaws in surgical instruments. Instead of developing what would work best, the manufacturers were actually going to make what people want!

Adapting to Our Instruments

The result is that we adapt to our instrumentation while our inanimate tools lie there impassively, and do not change. We select instrumentation based on what the supply cabinet holds and our experience will allow. Like the golfer who plays an entire round with a seven iron, we are often left to making do with what we have. Thus we develop the technical ploys and innovative maneuvers that get us past the shortcomings of our instruments. The story is told of a woman, a professional golfer, who was actually taught to play solely with a seven iron. From tee box to putting green only the seven iron. When she was consistently shooting in the 80s, the fundamentals were mastered. Only then was her father willing to introduce her to the other clubs (instruments in the surgical kit).

Behind every instrument and technical ploy is an operation that is needed, a patient who depends on the outcome, and a surgeon hoping to achieve the planned result. Surgery is about achieving the successful stroke, but once the successful stroke is achieved,

the surgeon is ready to appreciate and utilize the nuances of expanded instrumentation. New designs result and our passive instruments morph into the effective constructs of our imagination.

Improving Our Instruments

The evolution of surgical instrumentation is a reflection of our collective surgical experience. The orthognathic kit as it exists today is a remarkable achievement of surgical ergonomics. We are in the midst of an instrumentation revolution in implant surgery. Minimally invasive surgery, trauma surgery, and reconstruction are all undergoing fundamental changes in instrumentation and technique.

Technical notes in *JOMS* provide the seeds for these evolving instrument designs. Clinical and bench studies explore the details that will improve our techniques. This month's issue of *JOMS* is demonstrative of our advances in improving our instruments. Spencer et al¹ looked at the important issue of screw head design, especially as it impacts on screw placement over a range of insertion angles. As their article title says, they understood that design affects performance. Placement of hardware in regions with poor access and poor visibility requires screws that can be inserted and do not fall from the driver head during placement. Their experimental design was built around this critical clinical issue. In other arenas of evolving instrumentation in this issue of *JOMS*, Trou-

lis et al² continue to evolve endoscopic technique over an expanding range of indications utilizing new instrumentation. Herford³ is gaining valuable experience on the nuances of transport osteogenesis devices.

The techniques and instrumentation of oral and maxillofacial surgery are evolving simultaneously as these surgeons work closely with designers and manufacturers. Like other accelerating technologies, advances in surgical instrumentation appear boundless. We will see advances that begin with pearls of technique wisdom. They are supported by those who master the fundamentals and have the vision to identify clinical problems that can be solved . . . with the right tools.

LEON A. ASSAEL, DMD

References

1. Spencer KR, Ferguson JW, Smith AC, et al: Screw head design: An experimental study to assess the influence of design on performance. *J Oral Maxillofac Surg* 62:473, 2004
2. Troulis MJ, Williams WB, Kaban LB: Endoscopic mandibular condylectomy and reconstruction: Early clinical results. *J Oral Maxillofac Surg* 62:460, 2004
3. Herford AS: Use of a plate-guided distraction device for transport distraction osteogenesis of the mandible. *J Oral Maxillofac Surg* 62:412, 2004